



**DEPARTMENT OF TRANSPORTATION**

**[4910-22-P]**

**Federal Highway Administration**

**FHWA Docket No. FHWA-2015-0020**

**Revision of Thirteen Controlling Criteria for Design; Notice and Request for Comment**

**AGENCY:** Federal Highway Administration (FHWA), DOT.

**ACTION:** Notice; request for comment.

**SUMMARY:** The geometric design standards for projects on the National Highway System (NHS) are incorporated by reference in FHWA regulations. These design standards are comprehensive in nature, covering a multitude of design characteristics, while allowing flexibility in application. Exceptions may be approved on a project basis for designs that do not conform to the minimum or limiting criteria set forth in the standards, policies, and standard specifications.

The FHWA is updating its policy regarding controlling criteria for design. The current policy identifies 13 controlling criteria for design and requires formal design exceptions when any of the 13 controlling criteria are not met. The FHWA intends to further streamline the controlling criteria, and the application of these criteria, based on the results of recent research that evaluated the safety and operational effects of the 13 controlling criteria. The FHWA also intends to clarify when design exceptions are required and the documentation that is expected to support such requests. This notice solicits comments on the proposed revisions to the 13 controlling criteria for the design of

projects on the NHS that require a design exception when adopted design criteria are not met, in accordance with FHWA regulations.

**DATES:** Comments must be received on or before [Insert date 60 days after date of publication in the Federal Register]. Late comments will be considered to the extent practicable.

**ADDRESSES:** Mail or hand deliver comments to the U.S. Department of Transportation, Dockets Management Facility, Room W12-140, 1200 New Jersey Avenue SE., Washington, DC 20590, or fax comments to (202) 493-2251.

Alternatively, comments may be submitted to the Federal eRulemaking portal at <http://www.regulations.gov>. All comments must include the docket number that appears in the heading of this document. All comments received will be available for examination and copying at the above address from 9 a.m. to 5 p.m., e.t., Monday through Friday, except Federal holidays. Those desiring notification of receipt of comments must include a self-addressed, stamped postcard or you may print the acknowledgment page that appears after submitting comments electronically. Anyone is able to search the electronic form of all comments in any one of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, or labor union). Anyone may review DOT's complete Privacy Act Statement in the Federal Register published on April 11, 2000 (Volume 65, Number 70, Pages 19477-78).

**FOR FURTHER INFORMATION CONTACT:** For questions about the program discussed herein, contact Elizabeth Hilton, Geometric Design Engineer, FHWA Office of Program Administration, (512) 536-5970 or via email at [elizabeth.hilton@dot.gov](mailto:elizabeth.hilton@dot.gov). For

legal questions, please contact Robert Black, Office of the Chief Counsel, (202) 366-1359, or via email at Robert.Black@dot.gov. Office hours are from 8:00 a.m. to 4:30 p.m., e.t., Monday through Friday, except Federal holidays.

## **SUPPLEMENTARY INFORMATION:**

### **Electronic Access and Filing**

You may submit or retrieve comments online through the Federal eRulemaking portal at: <http://www.regulations.gov>. The Web site is available 24 hours each day, 365 days each year. Please follow the instructions. Electronic submission and retrieval help and guidelines are available under the help section of the Web site. An electronic copy of this document may also be downloaded from the Office of the Federal Register's home page at: <http://www.archives.gov> and the Government Printing Office's Web page at: <http://www.access.gpo.gov/nara>.

### **Purpose of This Notice**

The FHWA is requesting comment on proposed revisions to the 13 controlling criteria for the design of projects on the NHS that require a design exception when not met, in accordance with 23 CFR 625.3(f). Design exceptions are an administrative tool used to document an engineer's evaluation of possible solutions to a specific design issue, including the operational and safety performance of each option, impacts to the human and natural environment, and other factors, and demonstrating the reasons a particular solution that does not meet applicable design standards was selected. Many States have their own process for reviewing design deviations when State or Federal design criteria are not met. When used in this Notice, the term 'design exception' refers to documentation prepared for projects on the NHS when a controlling criterion is not met,

and that must be approved by the FHWA or on behalf of FHWA if a State Transportation Agency (STA) has assumed this responsibility through a Stewardship and Oversight agreement. Stewardship and Oversight agreements set forth the agreement between FHWA and each STA on the roles and responsibilities of FHWA and the STA with respect to Title 23 project approvals and related responsibilities and oversight activities. The FHWA also intends to clarify when design exceptions are required and the documentation that is expected to support such requests.

Comments received through this Notice will be considered by FHWA when revising the controlling criteria for the design of projects on the NHS, as well as design exception documentation and application.

## **Background**

As codified in 23 CFR 625.3 and 625.4, the geometric design standards for projects on the NHS are A Policy on Geometric Design of Highways and Streets (2001) and A Policy on Design Standards Interstate System (2005), published by the American Association of State Highway and Transportation Officials (AASHTO). Rulemaking is underway to adopt the current (2011) edition of A Policy on Geometric Design of Highways and Streets. These design standards are comprehensive in nature, covering a multitude of design characteristics, while allowing flexibility in application. As codified in 23 CFR 625.3(f), and in accordance with the delegated authority provided by FHWA Order M1100.1A, exceptions may be approved on a project basis for designs that do not conform to the minimum or limiting criteria set forth in the standards, policies, and standard specifications adopted in 23 CFR 625.

The FHWA issued a policy memorandum on April 15, 1985, available on the docket for this notice, and on FHWA's Web site at <http://www.fhwa.dot.gov/design/standards/850415.cfm>, which identified 13 criteria contained in A Policy on Geometric Design of Highways and Streets and designated them as controlling criteria. The policy required formal design exceptions when any of the 13 controlling criteria were not met.

The FHWA proposes to streamline the 13 controlling criteria to refine the focus on criteria with the greatest impact on road safety and operation. This streamlined application of the controlling criteria is consistent with the industry's move toward a modified design approach, often referred to as performance based practical design (PBPD), and will reduce the instances when a design exception must be prepared when applicable design standards are not met for projects on the NHS. The controlling design criteria set forth in 1985 are: design speed, lane width, shoulder width, bridge width, horizontal alignment, superelevation, vertical alignment, grade, stopping sight distance, cross slope, vertical clearance, horizontal clearance, and structural capacity. The term 'horizontal clearance' was initially interpreted as the 'clear zone' described in the AASHTO Roadside Design Guide (<http://www.fhwa.dot.gov/design/standards/850415.cfm>), but in the early 1990s was clarified to mean 'lateral offset to obstruction' as described in the AASHTO geometric design policies (<http://www.fhwa.dot.gov/design/standards/930525.cfm>). Recent research, culminating in publications of the most recent Highway Capacity Manual (2010, Transportation Research Board) and the Highway Safety Manual (2010, AASHTO), developed much greater knowledge of the traffic operational and safety

effects of the controlling criteria than was available when they were established. The NCHRP Report 783 “Evaluation of the 13 Controlling Criteria for Geometric Design” (2014) specifically examined the safety and operational effects of the existing controlling criteria.

The PBPD is an approach to decisionmaking that encourages engineered solutions rather than relying on minimum, maximum, or limiting values found in design criteria. The PBPD is grounded in an analytic framework that enables transportation agencies to utilize existing design flexibility and analytical tools in a way that maximizes benefits while minimizing costs. The PBPD does not disregard engineering guidance or standards. Rather, flexibility in design typically requires more information and a higher level of analysis when defining and deciding on the most appropriate design value for a particular location. Consistent with FHWA’s efforts regarding PBPD and to ensure that design exceptions are only required for criteria with significant safety or operational effects, FHWA intends to streamline the controlling criteria based on the findings of recent research. Since 1985, the controlling criteria have been applied to all projects, regardless of roadway type or context. The NCHRP Report 783 found that the 13 controlling criteria had minimal influence on the safety or operations on urban streets. On rural roadways, freeways, and high-speed urban/suburban roadways, a stronger connection to safety and operations was found for some of the criteria than for others.

### **Proposed Revisions to Controlling Criteria**

Based on the findings of NCHRP Report 783 and FHWA’s own assessment and experience, FHWA proposes to eliminate the following controlling criteria:

- Bridge Width

- Vertical Alignment
- Lateral Offset to Obstruction.

To improve clarity, FHWA proposes to rename the following existing controlling criteria:

- Horizontal Alignment to be renamed Horizontal Curve Radius
- Grade to be renamed Maximum Grade
- Structural Capacity to be renamed Design Loading Structural Capacity.

The resulting controlling criteria for design are proposed as follows:

- Design Speed
- Lane Width
- Shoulder Width
- Horizontal Curve Radius
- Superelevation
- Stopping Sight Distance
- Maximum Grade
- Cross Slope
- Vertical Clearance
- Design Loading Structural Capacity.

The FHWA also proposes a revision to the application of the controlling criteria.

Most controlling criteria would apply only to high-speed [design speed  $\geq$  50 mph (80 km/h)] roadways. Only design loading structural capacity and design speed would continue to be applied to all NHS facility types. Research indicates that the current

controlling criteria are less influential on the traffic operational and safety performance of low-speed urban and suburban arterials than other features such as intersection design and access management strategies. Therefore, consistent with FHWA's risk-based approach to stewardship and oversight, FHWA intends to focus application of the controlling criteria on high-speed NHS roadways [design speed  $\geq$  50 mph (80 km/h)]. On low-speed NHS roadways [design speed  $<$  50 mph (80 km/h)], design exceptions are proposed to only be required by FHWA for deviations from the design speed or design loading structural capacity criteria. Exceptions to the controlling criteria must be carefully evaluated and approved by FHWA or on behalf of FHWA if an STA has assumed the responsibility through a Stewardship and Oversight agreement.

While all of the criteria contained in the adopted standards are important design considerations, they do not all affect the safety and operations of a roadway to the same degree, and therefore should not require the same level of administrative control. Based on the findings of recent research and FHWA's assessment and experience, a brief discussion on each of the proposed changes to the controlling criteria is provided below.

Controlling Criteria FHWA proposes to eliminate:

1. **Bridge width** is proposed to be removed from the list of controlling criteria because research found little relationship between bridge width and crash frequency on rural, two-lane highways and surmised the same would be true for other roadway types. Lane and shoulder width criteria apply to roadways and bridges, so any deficiency in bridge width will require design exception documentation if the lane or shoulder width criteria is not met under this proposal. Design criteria allow lesser shoulder width, and therefore lesser bridge widths, on long bridges [overall length over 200



feet (60 m)]. If the minimum lane or shoulder widths are not provided on a long bridge, the deviation would be documented as a lane or shoulder width design exception under the proposed revisions to controlling criteria.

2. **Vertical alignment** is proposed to be removed from the list of controlling criteria.

Three of the existing criteria relate to vertical alignment. Crest vertical curve design is covered under the stopping sight distance criterion. Grade is explicitly covered as a separate criterion, leaving only sag vertical curve length to be covered under the vertical alignment criterion. While research has confirmed the interrelationship between vehicle headlight illuminations, sag vertical curves, and sight distance to features in the roadway, no relationship has extended to the effect of these combined elements on crashes. Furthermore, except when a horizontal curve or overhead structure is also present, sag vertical curve length is not critical under daytime conditions when the driver can see beyond the sag vertical curve, or at night, when vehicle taillights and headlights make another vehicle on the road ahead visible in or beyond a sag vertical curve.

3. **Lateral offset to obstruction** is proposed to be removed from the list of controlling criteria because on rural roadways, the controlling criterion for shoulder width ensures that there will be at least 18 inches of lateral offset to roadside objects. Lateral offset is most relevant to urban and suburban roadways to ensure that mirrors or other appurtenances of heavy vehicles do not strike roadway objects and so that passengers in parked cars are able to open their doors. While these are important considerations, they do not rise to the same level of effect as other controlling criteria proposed to be retained.

Controlling Criteria FHWA proposes to retain for roadways on the NHS with a design speed equal to or greater than 50 mph (80 km/h), unless otherwise noted:

1. **Design speed** is proposed to be retained as a controlling criterion for all facilities on the NHS. Design speed is different from the other controlling criteria in that it establishes the range of design values for many of the other geometric elements of the highway. Because of its effect on a highway's design, the design speed is a fundamental and very important choice that a designer makes. In recognition of the wide range of site-specific conditions, constraints, and contexts that designers face, the design standards allow a great deal of design flexibility by providing ranges of values for design speed. For most cases, the ranges provide adequate flexibility for designers to choose an appropriate design speed without the need for a design exception. If a limited portion of an alignment must be designed to a lower speed, it is generally more appropriate to evaluate specific geometric element(s) and treat those as design exceptions, instead of evaluating an exception for the design speed of the roadway.
2. **Lane width** is an important design criterion with respect to crash frequency and traffic operations on high-speed and rural highways. The design standards provide the flexibility to choose lane widths as narrow as 10 feet on some facilities.
3. **Shoulder width** has substantial effect on crash frequency and on traffic speeds on rural highways.
4. **Horizontal curve radius**, previously called horizontal alignment, has a documented relationship to crash frequency on rural highways of all types. Curve radius also influences traffic operations on urban/suburban arterials. Superelevation is the other

- main aspect of horizontal alignment and is being retained as independent controlling criterion.
5. **Superelevation** has a documented relationship to crash frequency on rural, two-lane highways and research suggests this would also be true on rural multilane highways and freeways. Superelevation is generally not provided on low-speed urban/suburban streets.
  6. **Stopping Sight Distance (SSD)** is proposed to be retained as a controlling criterion because sufficiently long SSD is needed to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Research found that SSD less than specified by the design standards for crest vertical curve design, combined with a hidden feature such as a curve, intersection, or driveway, resulted in increased crashes on high speed roadways. Retention of SSD as a controlling criterion will ensure that deviations from this criterion are examined on a case-by-case basis, to determine whether site characteristics and crash history are indicative of potential areas needing attention. From an operational perspective, SSD generally does not affect operations on freeways under free-flow conditions. However, when freeways operate at near-capacity, limited SSD may further reduce capacity below the levels expected based on current predictive models. These impacts are typically examined during project development.
  7. **Maximum grade** is proposed as a controlling criterion but minimum grade is not. The existing controlling criteria of 'grade' includes both maximum and minimum grade. Maximum grade is proposed to be retained due to its relationship to crash frequency on rural, two-lane highways and the effect of steep grades on traffic

- operations on high-speed roadways. Minimum grade is proposed to be excluded because while it does influence roadway drainage, minimum grade alone does not ensure sufficient drainage and does not rise to the level of the controlling criteria.
8. **Cross slope** is proposed to be retained as a controlling criterion to address drainage issues. While research has not been conducted to determine whether there is a relationship between the normal cross slope of roadway pavements and crash frequency, our experience is that inadequate drainage could contribute to vehicle loss of control under some circumstances. Due to the relationship between cross slope and drainage, especially when combined with minimum grades, cross slope is proposed to be retained as a controlling criterion.
9. **Vertical clearance** is proposed to be retained as a controlling criterion. While vertical clearance does not affect operations on the roadway other than for those vehicles that are taller than the available vertical clearance allows, vertical clearance crashes can have severe impacts on operations by damaging overpasses and other structures, resulting in extended road closures. In addition, inadequate vertical clearance on Interstate freeways impacts military defense routes and requires additional coordination with the Surface Deployment and Distribution Command Transportation Engineering Agency.
10. **Design Loading Structural Capacity** is related to the strength and service limit state designs, not to traffic operations or the likelihood of traffic crashes. Previously called ‘structural capacity,’ FHWA proposes to clarify that the applicable criterion covered herein relates to the design of the structure, not the load rating. Design loading structural capacity is important in maintaining a consistent minimum standard for safe

load-carrying capacity and deviations from this criterion should be extremely rare.

Design loading structural capacity is proposed to be retained as a controlling criterion regardless of the design speed for the project. Exceptions to design loading structural capacity on the NHS could impact the mobility of freight, emergency and military vehicles, and the traveling public and requires additional coordination with the FHWA Office of Infrastructure.

### **Design Documentation**

As codified in 23 CFR 625.3(f), and in accordance with the delegated authority provided by FHWA Order M1100.1A, exceptions may be approved on a project basis for designs that do not conform to the minimum or limiting criteria set forth in the standards, policies, and standard specifications adopted in 23 CFR 625. Under this proposal, formal design exceptions, subject to approval by FHWA, or on behalf of FHWA if an STA has assumed the responsibility through a Stewardship and Oversight agreement, would be required for projects on the NHS only when the controlling criteria are not met. The FHWA expects documentation of design exceptions to include all of the following:

- Specific design criteria that will not be met.
- Existing roadway characteristics.
- Alternatives considered.
- Analysis of standard criteria versus proposed design criteria.
  - Supporting quantitative analysis of expected operational and safety performance
  - Right-of-way impacts
  - Impacts to human and natural environment

- Impacts to the community
- Impacts on the needs of all users of the facility
- Project cost
- Proposed mitigation measures.
- Compatibility with adjacent sections of roadway.
- Possibility of a future project bringing this section into compliance with applicable standards.

Design Speed and Design Loading Structural Capacity are fundamental criteria in the design of a project. Exceptions to these criteria should be extremely rare and FHWA expects the documentation to provide the following additional information.

- Design Speed exceptions must address:
  - Length of section with reduced design speed compared to overall length of project.
  - Measures used in transitions to adjacent sections with higher or lower design or operating speeds.
- Design Loading Structural Capacity exceptions must address:
  - Verification of safe load-carrying capacity (load rating) for all State unrestricted legal loads or routine permit loads, and in the case of bridges on the Interstate, all Federal legal loads.

The FHWA encourages agencies to document all design decisions to demonstrate compliance with accepted engineering principles and the reasons for the decision.

Deviations from criteria contained in the standards for projects on the NHS, but which are not considered to be controlling criteria, should be documented by the STA in accordance

with State laws, regulations, directives, and safety standards. Deviations from criteria contained in standards adopted by a State for projects not on the NHS should be documented in accordance with State laws, regulations, directives, and safety standards. States can determine their own level of documentation depending on their State laws and risk management practices.

The proposed revisions to the controlling criteria and design documentation requirements will be published in final form after considering comments received regarding the proposed changes.

The FHWA requests comments on the revised guidance memorandum, which is available in the docket (FHWA-2015-0020). The FHWA will respond to comments received on the guidance in a second Federal Register notice, to be published after the close of the comment period. That second notice will include the final guidance memorandum that reflects any changes implemented as a result of comments received.

**Authority:** 23 U.S.C. 109 and 315; 23 CFR 1.32 and 625; 49 CFR 1.85.

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